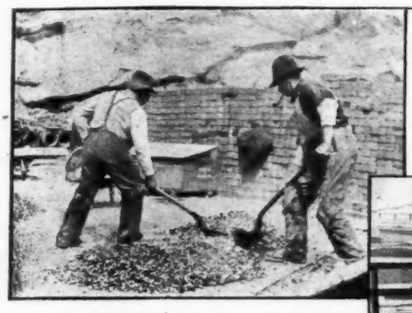
Engineering Library

15

PUBLIC WORKS

CITY COUNTY STATE



Above: "Tarvia-KP" and stone are turned over by hand until all stones are coated. Then sand is added.

Right: The hole to be patched is cleaned out and the bottom and sides are painted with "Tarvia-KP."

Tarvia-KP
FOR COLD PATCHING

Right: The mixture is well tamped and covered with screenings.

The mixture of "Tarvia-KP," stone and sand is put in the prepared hole.

A seal-coat of ½ gallon of "Tarvia-KP" to the square yard is spread over the patch.

Screenings are scattered over the seal-coat and the patch is again tamped.

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For winter, with its alternate freezing and thawing will ruin a road, whereas a *little* care *now* may mean a vast saving in actual dollars later on.

"Tarvia-KP" has an astonishing variety of uses. It is employed in patching macadam, asphalt, bituminous-concrete and cement-concrete roads.

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CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
Published Weekly by Public Works Journal Corporation

Publication Office, Floral Park, N. Y. Advertising and Editorial Offices at 243 W. 39th St., New York, N. Y.
Entered as Second-Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879.

Vol. 51 OCTOBER 8, 1921 No. 15

Sewage Treatment at Allentown

Located near main business section. Second municipal instillation of the "direct oxidation" electrolytic process, with sedimentation basins and sludge beds.

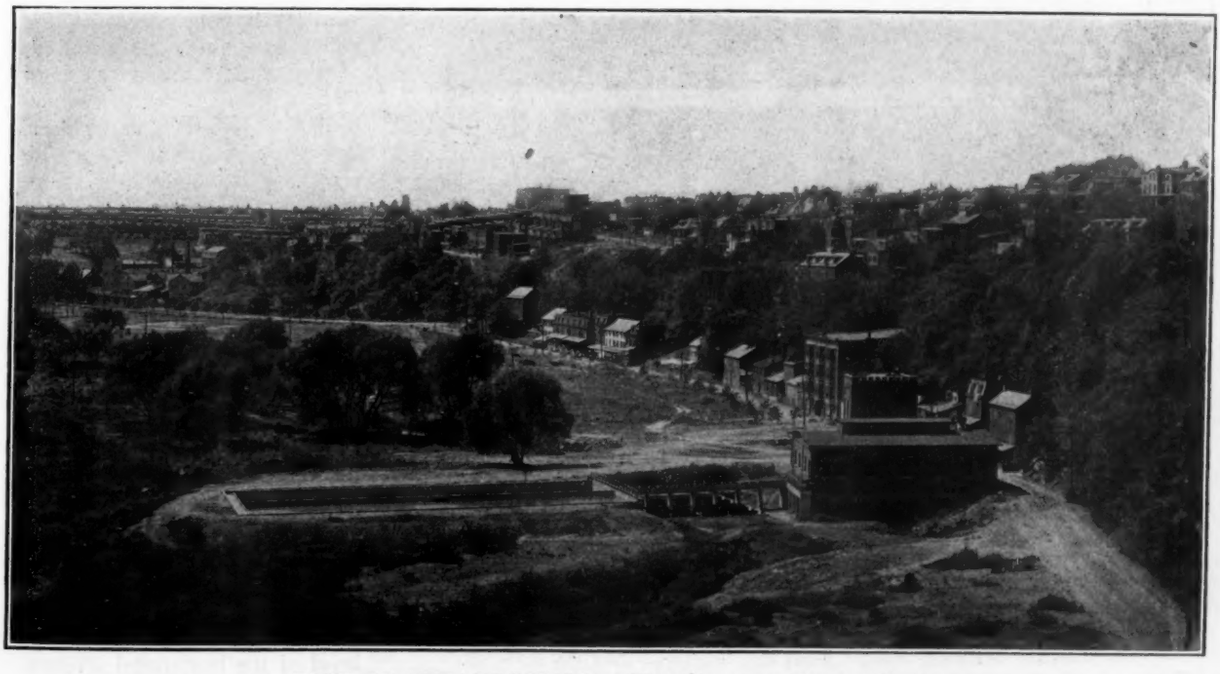
By H. F. Bascom

A sewage treatment plant went into service at Allentown, Pa., on July 27 of this year which is the largest and most complete of its kind yet constructed in the country and the second to be put into service as a municipal plant, although others have been operated as large-scale experimental plants. This plant is of the type known as the Landreth or "direct oxidation" process.

Allentown has grown rapidly from a population of 35,416 in 1900 to nearly 80,000 in 1920 and has enjoyed the distinction of being one of the cleanest and most sanitary of the smaller cities of the country. This, however, was in spite of the fact that not one line of sanitary sewers had ever been constructed in the city until 1920. The usual plan was for each house owner to excavate or drill a cesspool or "sink" (as they are called locally) to a few feet below the surface where a loose, porous limestone rock formation was generally encountered into which the sewage matters disappeared.

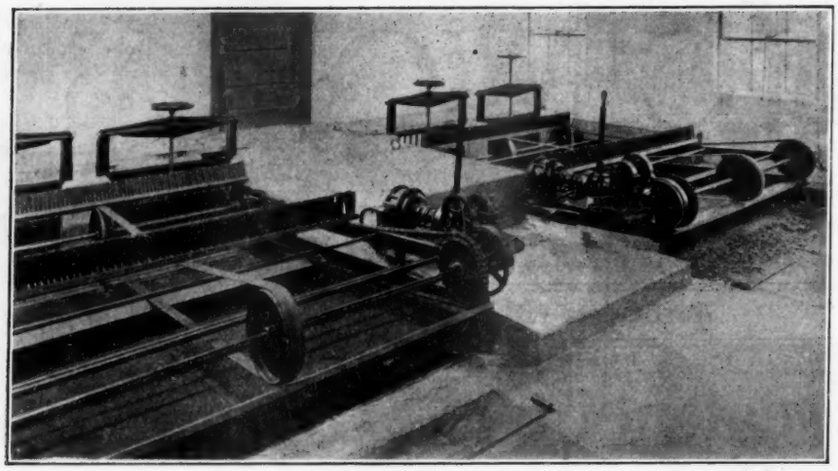
Several attempts were made to secure local legislation that would enable the city to construct a sewage disposal plant but these met with failure. Several consulting sanitary experts were engaged on different occasions, the latest of these being in 1908, when plans were prepared and presented to the state department of health for approval, which department granted the city, on July 27 of

*City Engineer of Allentown



VIEW OF SEWAGE DISPOSAL PLANT AND SURROUNDINGS

Plant is in foreground. Building at right contains mechanical and electrolytic apparatus. Left of this are sludge beds, and left of these are the sedimentation basins. Buildings on the city's main street are seen at the extreme right.



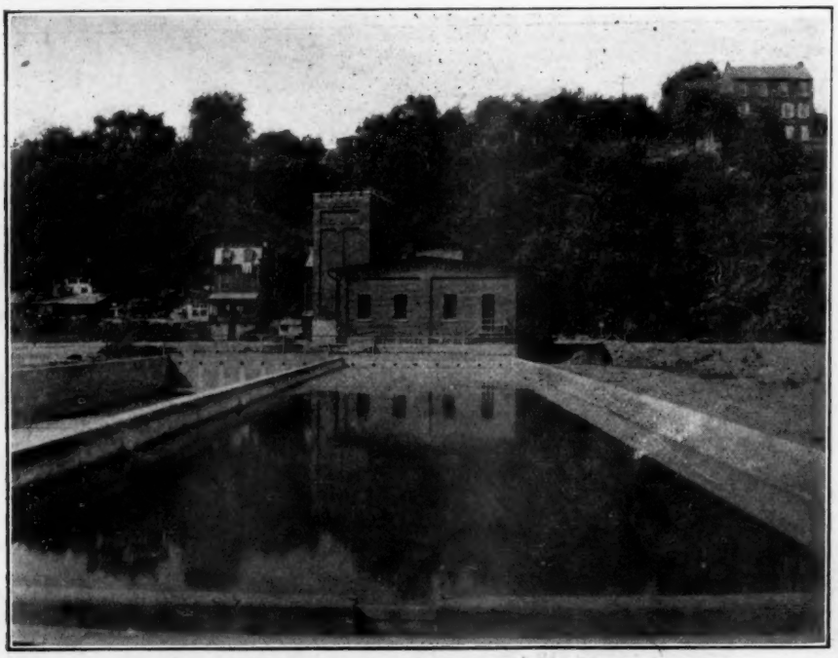
SCREENS AND BRUSHES
Screenings can be seen on the floor in front of the right-hand screen, where they are thrown by the brushes.

that year, a permit to construct the system, but no advantage was taken of this permit by the city. At one time a charter was obtained by a private corporation permitting the construction of a system and engineers were engaged to design and construct a system, but the strength of the opposition to private ownership of a sewerage system for the city or other reasons prevented the company from carrying out the project.

The writer, when serving a term as city engineer from April, 1903, to April, 1906, and as member of select council from January, 1910, to December, 1911, and again from the latter date to November, 1913, during two terms as chairman of the finance committee of city council, did his utmost to have plans prepared for the construction of a sewage disposal system. He is again (since February, 1918) occupying the position of city engineer and in the early part of 1919 he combed the whole field of possibilities for a successful or at least favorable type of system. A farm of 460 acres situated along the Lehigh river between Allentown and Bethlehem had been purchased for sewage disposal purposes at a cost of $125,000 and his first recommendation was that this be sold, which was adopted by city council and in November of 1920 a large corporation purchased it, paying $141,000. The plan finally adopted for disposal was that known as the "direct oxidation" or Landreth process, by which the sewage, after having been passed over a screen, is treated with a solution of lime and then passed through electrolizing units, on emerging from which all odor has disappeared and practically all of the bacteria, and the effluent compares favorably with the river water into which it is discharged.

The plant was located in an old building which had formerly been used as a pumping station by the water department and was still owned by the city but not used. It was located on the Little Lehigh river, within 1,500 feet of the main business center of the city, and immediately adjacent to a number of residences.

The building was altered and reconstructed to a considerable extent, both to better adapt it for the installation of the plant and also to improve the appearance both exterior and interior. In addition, the surrounding land, which was low and swampy, has been graded up and will be planted to sod and shrubbery with a view to giving an attractive appearance to the surroundings of the building and the construction of a park, $36,930 being paid the contractor, George H. Hardner, for the reconstruction of the building, of which about $4,500 is for the grading.

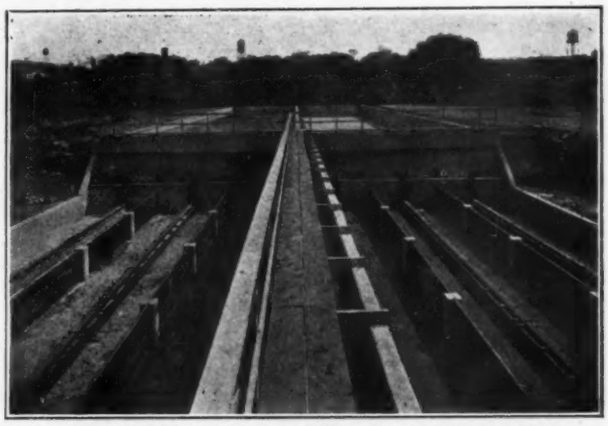


BUILDING VIEWED FROM END OF SEDIMENTATION BASINS.
Tower at left contains lime storage equipment. Basin outlet in foreground center. Residences are shown directly opposite building.

The road leading to the building falls below the hydraulic gradient of the sewer which it is necessary to maintain in order to operate the plant by gravity, and for a considerable distance each side of the plant the sewer mains leading to it act as inverted siphons, that coming from the west being an 18-inch cast iron pipe and that from the east a 24-inch cast iron. These unite into an 18-inch iron pipe which rises 15½ feet to the level of the horizontal screens. Under each line near the

riser is an 8-inch blow-off controlled by valves, these blow-offs leading to a sump under the disposal building. It is proposed that the sewage will ordinarily flow by gravity on to the screens, and be drawn off into sump only when it is desired to empty the inverted siphons for any reason or flush out sediment in them. For emptying the sump there are provided two 4-inch pumps, each with a capacity of 500 gallons a minute against a 20-foot head, each operated by a G. E. motor, and regulated by floats in the sump pit so as to operate first one pump and later, if the sump continues to fill, the second pump. In case of failure to operate, the pumps are connected with an electric alarm bell to call the operator.

The same contractor, George H. Hardner, also received the contract for laying these inverted siphons for installing the electrolyzing units, pumps and other piping, switchboards and other appurtenances; also for building the sedimentation basin and sludge beds. The apparatus inside of the building, which includes everything except the sediment tanks, sludge beds and channels and pipes connected with them, was sublet to the Municipal Disposal Company, which purchased the electrolyzing apparatus from the Direct Oxidation Process Corporation. The cost of the mechanical portions of the plant was $134,576 and that of the basins and beds was $33,443, of which amount $5,600 was for concrete piling for foundations. The inverted siphons cost about $53,000, of which about one half was for the pipe.



SEDIMENTATION BASINS AND SLUDGE BEDS

View taken from building. Walk in center rests on flume carrying effluent to basins. Sludge beds are in foreground.

MODE OF OPERATION OF THE PLANT

The sewage, on entering the plant, passes through a screen, is then dosed with lime and passes into one of the electrolyzing units. About

VIEW OF INTERIOR OF BUILDING

Electrolyzing units on the lower floor. Beyond these, at the right, the venturi meter, with its recording apparatus on the gallery above. On the gallery, at the right, the attendant's desk; in the center, the switchboards, one for each electrolytic unit. At the left, the lime feed apparatus.

a minute is occupied in passing through this unit, when the effluent is discharged into an open concrete flume which leads it to one of the two sedimentation tanks. From these tanks the effluent is discharged directly into the Little Lehigh river, which is only a few feet distant. The sludge collected in the bottoms of the sedimentation tanks is drawn off onto sludge beds, from which it will be removed and disposed of either for fertilizing or for filling in the low land near the plant. At present the amount of sewage is so small that its slow flow through the inverted siphon would tend to cause deposits therein, and it is allowed to flow by gravity to the sump and is pumped from this to the screens. There are two screens, two appliances for feeding lime, three electrolyzing units with room for a fourth for future installation, two sedimentation tanks and six sludge beds. In addition there is a Decarie incinerator for burning the screenings and a considerable plant for handling the lime.

The lime is dumped directly from the truck through an out-door opening onto a coarse screen which holds out any large lumps, these to be broken up by hand. From this screen it falls to the floor of the crusher room, where it is discharged into a Sturtevant crusher from which the discharge is to the boot of a bucket elevator. This raises the lime, broken into small particles, to a fifty-ton tank, where it is stored. From this tank it is drawn as needed into a Raymond pulverizer, where it is broken up into a fine powder, that which is sufficient pulverized being drawn up by a column of moving air into a "cyclone" collector and a tubular collector. From this it is drawn down into a hopper for use. From the hopper it is discharged through two pipes to the duplicate lime feeding apparatus, which can be adjusted to feed the pulverized lime at any desired rate into a small box where it is dissolved in treated sewage and discharged into the raw sewage just before the latter enters the electrolizing units.

The screens are located in a screen room 22 feet 6 inches by 21 feet 6 inches. They consist of 3/16-inch steel plates 8 by 8 feet with ¼-inch holes. The solid matter removed on these screens is brushed off onto the floor at the end of the screen by means of four brushes fastened on two chain belts which are run by sprocket wheels operated by an electric motor. Screenings are shoveled up at intervals as necessary and dropped through a manhole into the room below, where they are burned in a Decarie incinerator, coal being used for fuel.

The sewage as it goes to the electrolizing units passes through a Simplex venturi meter, which is provided with an automatic recorder which keeps a record of the daily flow of sewage.

Each of the electrolyzing units has a nominal capacity of one million gallons in 24 hours. These units are similar to those described in "Municipal Journal" for November 16, 1918, except for a few minor improvements. The room in which these are located, together with the piping and venturi meter, occupies practically the entire area of the building, the dimensions of which are 76 by 46 feet. The three are located on the basement floor. On two sides of the room is a gallery slightly above ground level, at which level are located the switchboard, lime feeding apparatus, operator's desk, etc. The incinerator and a furnace for heating the building are located in the basement.

The only opportunity for odor in the building, because the only place where the sewage is exposed to the atmosphere, is in the screen room. This is ventilated by means of a ventilator, but so far it has been necessary to use this only once or twice a day, generally when the pumps are first started after the sewage has been stored for nearly 24 hours in the inverted siphon pipes.

The sedimentation tanks are of concrete, each 150 feet long by 30 feet wide and from 7 to 11 feet deep. Channels are located in the bottom of each tank and covered with perforated plates, the channels to be used for drawing off the sludge onto sludge beds. A pipe is also provided for drawing off the supernatant liquid preparatory to removing the sludge.

This table shows that the electrolizing unit reduced the total bacteria by 99.3 per cent and the B. coli by 99.97 per cent. The total reduction by both this and the sedimentation basin was 99.95 per cent of total bacteria and 100 per cent. B. coli. While the retention in the sedimentation basin is, of course, much longer than it will be when the plant is running at its normal capacity of 3,000,000 gallons per day, the electrolizing units are operated at the rate of 1,000,000 gallons a day per unit, one unit being used only about two hours per day at present. The result obtained by the electrolizing unit may therefore be assumed to be the same as will be obtained when the plant is running at full capacity.

As stated, the plant is located within 1,500 feet of the main business street, this being possible because of the absence of nuisance and the small area required. The latter and the fact that a long and expensive trunk line to a distant disposal plant is obviated, and the ease of operation, all seem to be distinct advantages of this system. The plant is convenient to the center of the city and the railroad stations and can easily be inspected by officials from other cities, who will be welcomed at any time.

Road Machinery for Venezuela

The Venezuelan Commercial Agency in this country reports that the establishment of close diplomatic and commercial relations between Venezuela and the United States is likely to result in a great increase in road building in the former country, calling for the use of considerable numbers of steam rollers and other standard road building apparatus.

Macadam is the principal type of roadway built so far in the mountain regions, and natural dirt on the level plains of the interior. However, oil for sprinkling is now being used on these roads. A large number of steel bridges have been required and for the most part have been imported and erected by American concerns. "American enterprise is welcomed in Venezuela, which is adopting an extremely friendly attitude toward foreigners.

Highway Detours in Illinois

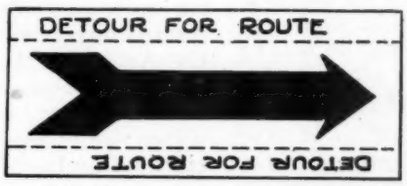
Well worked out scheme of signs for directing travel around roads under construction. Instructions to highway engineers and inspectors.

The Division of Highways of Illinois has issued a "Manual on Road Construction for Resident Engineers and Inspectors" which was prepared by B. H. Piepmeier, engineer of construction; the purpose of which is "to set forth briefly the requirements of the Department of Public Works and Buildings in the construction of various types of roads." This manual contains sixty pages of valuable instructions and suggestions, well classified and clearly stated, from which we may later excerpt some portions. Below we give the instructions relative to detours:

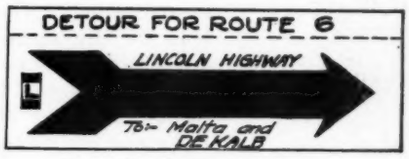
DETOUR AND BARRICADE SIGNS

All detour, slow and barricade signs shall be erected and maintained by the engineer in charge of the road or bridge being improved. All signs necessary to guide the traveling public around any highway that has been closed for improvement shall be secured from your district engineer.

All signs erected shall be securely fastened to a solid background by means of paste or tacking completely around the margin at intervals of not more than three inches. If thin paper signs are supplied they may be pasted to a board background, if the heavy cardboard sign is supplied it will have been dipped in paraffin or shellac to protect it from the action of the weather.



STANDARD DETOUR SIGN AS FURNISHED BY DEPARTMENT



STANDARD DETOUR SIGN SHOWING ENGINEER'S NOTATIONS BEFORE ERECTING

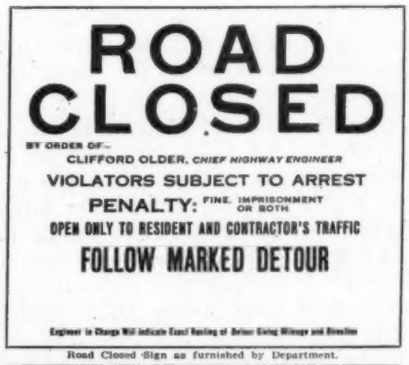
FIG. 3—STANDARD DETOUR SIGN

NOTE—Engineer in charge will indicate before erecting the sign, the Route number, name of Trail, its Emblem if the road has a name and emblem, the next town and County Seat or main City on the road.

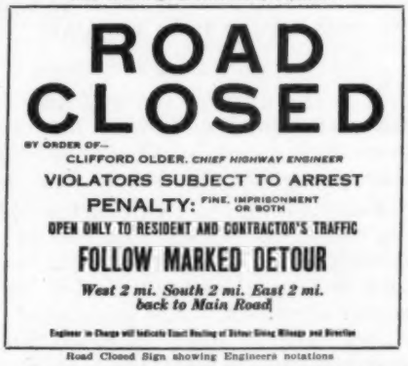
Slow Sign. The slow sign (Fig. 1) shall be erected on a post set in the outer edge of the shoulder about 400 feet ahead of the barricade. The top of the sign shall be about 4 feet from the ground line, the post supporting the sign shall not be smaller than a 2 x 4 and shall be set at least 2 feet into the ground.

Road Closed. The road closed sign (Fig. 2) shall be erected on two substantial posts set in front but independent of the barricade. The posts shall be at least 2 inches by 4 inches by 7 feet long and set two feet apart, and at least two feet into the ground at a point where they will not be disturbed by traffic. On the "Road Closed" sign you shall print carefully sufficient information to guide the traveling public around the road that is closed for improvement, i. e., N-2 mi.; W-3 mi.; S-2 mi. brings you back onto the road.

Detour Signs. A detour sign shall be fastened immediately below the "Road Closed" sign, with its arrow pointing in the direction of the detour. Detour signs shall be erected in such way that traffic going in both directions may readily follow the detour. There shall be at least two signs


ROAD CLOSED
BY ORDER OF—
CLIFFORD OLDER, CHIEF HIGHWAY ENGINEER
VIOLATORS SUBJECT TO ARREST
PENALTY: FINE, IMPRISONMENT OR BOTH
OPEN ONLY TO RESIDENT AND CONTRACTOR'S TRAFFIC
FOLLOW MARKED DETOUR

Road Closed Sign as furnished by Department.


ROAD CLOSED
BY ORDER OF—
CLIFFORD OLDER, CHIEF HIGHWAY ENGINEER
VIOLATORS SUBJECT TO ARREST
PENALTY: FINE, IMPRISONMENT OR BOTH
OPEN ONLY TO RESIDENT AND CONTRACTOR'S TRAFFIC
FOLLOW MARKED DETOUR
West 2 mi. South 2 mi. East 2 mi. back to Main Road

Road Closed Sign showing Engineers notations

FIG. 1—STANDARD WARNING SIGN

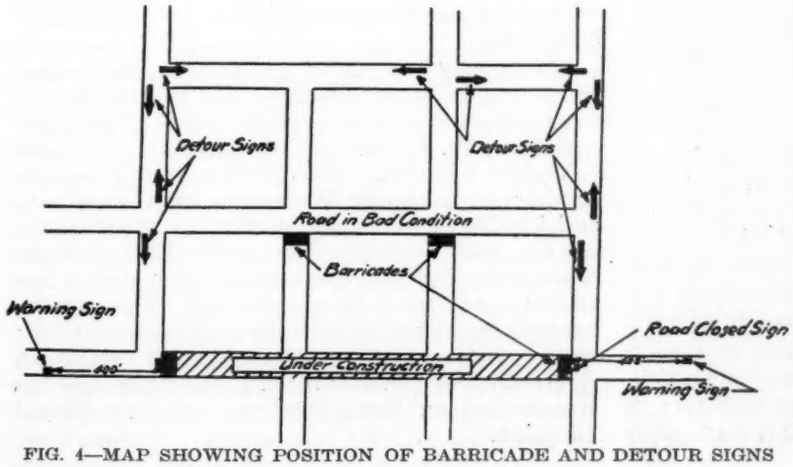


FIG. 4—MAP SHOWING POSITION OF BARRICADE AND DETOUR SIGNS

STANDARD WARNING SIGN FOR BARRICADES

FIG 2—ROAD CLOSED SIGN

at all cross or intersecting roads and a sign along the road at least every mile. If existing poles are not located in position desired substantial posts shall be securely set at the desired points and the "Detour" signs securely nailed to them. The post shall be set so that the traffic that is being detoured may readily see the sign and not fail to make the proper turn. Fig. 4 will serve as a guide in the location of the different signs.

Purchasing and Erecting. Unless otherwise instructed by your district engineer vou will make a memorandum of the sign boards and posts needed to detour the work at all times during its construction. You will then go to the nearest lumber yard and secure sufficient lumber for the signs needed and get a receipted bill, which you may turn in at the same time you forward your expense account. The contractor will probably loan you the necessary tools to make and erect the signs. If extra help is needed hire a man and get a receipt for the amount paid.

Maintenance of Signs. From time to time determine the signs that are actually needed to detour the traffic around that portion of the road that is closed. Try and check all signs each day or at least twice each week to see that they are in place. No excuse will be accepted for not having all signs erected and maintained in such way that inconvenience to the traveling public will be minimized.

Maintenance of Detour Road. If the road on which you have chosen to detour traffic is in need of dragging or maintenance, get in touch with the local township commissioner and exert your influence to have the road dragged. It might be well to determine your detours as soon as you arrive on the job and consult the highway commissioner concerning their maintenance. This will give the commissioner a more active interest in the construction of the road and will result in his co-operation from the start.

BARRICADES

It is the duty of the engineer to see that the contractor puts up proper barricades, maintains them during construction and completely removes them from the site before final acceptance.

Barricades should be constructed in the following manner: Posts shall be erected at 5-foot centers entirely across the roadway and at least one line of 2 x 6-inch timber spiked near the top of the posts. The posts shall be 6 inches by 7 feet long, of sound material and set at least 3 feet into the ground. In case it is necessary to permit the people living along the road entrance through the barricade, opening shall be provided, preferably near the center of the roadway and a substantial gate erected. The entire barricade shall then be whitewashed or painted white. The contractor shall be required to see that the barricades are locked and that proper individuals are supplied with keys until the final completion of the road. The contractor may arrange with each property owner living along the road to provide his own key and padlock which may be attached to the gate. When this arrangement is made each padlock forms a link of the locking chain. If the barricade is to remain for any considerable length of time, such as through a winter, it shall be painted with black stripes.

Standardization of Water Works Brass Goods

At the time of the convention of the New England Water Works Association at Bridgeport a meeting was held of three committees on Standardization of Brass Goods for Water Works appointed by the New England Water Works Association, the American Water Works Association and the National Association of Brass Manufacturers, respectively. This committee on September 14, after a detailed discussion, unanimously adopted a report to be presented to their respective organizations.

This report contained twelve items. Some of those of most interest to engineers and superintendents required that all brass goods intended for underground service should be made of a standardized mixture with definite limits of tolerance for each ingredient specified; that all essential dimensions and minimum weights be specified, the American Association of Brass Manufacturers being requested to submit suitable specifications for these two items, for approval by the two water works associations. Other items were the elimination from corporation cocks of the ⅜-inch size, round bodies, quarter-bend couplings and certain other features, with the understanding that the use of ½-inch and ⅝-inch sizes is to be discouraged. Also that lead flange cocks for 3A lead be the same as those for 2A lead; that all corporation cocks have two flat sides for wrench hold and those 2 inches or less have a hex on the inlet side; that all lead flange corporation cocks have the coupling thread used by the H. Mueller Manufacturing Co. for 2A lead pipe; that the thread on the inlet end of corporation cocks be either the Mueller thread, the coarse thread for wood mains, or the standard iron pipe thread, the last, however, to be discouraged; that all couplings (including meter couplings) and all solder nipples have full bore, and certain other items with respect to corporation cocks, curb cocks and couplings.

This report was signed by David A. Heffernan, water works superintendent of Milton, Mass., representing the New England Water Works Association; W. R. Edwards, of Paterson, N. J., and J. Walter Ackerman, of Watertown, N. Y., representing the American Water Works Association; and Fred Mueller, of the H. Mueller Manufacturing Co., and Fred Schulder, of the United Brass Manufacturing Co., representing the National Association of Brass Manufacturers. This report, we suppose, together with the specifications of the brass manufacturers for items one and two above referred to, will be submitted to the three societies represented on the committee for their formal adoption.

PUBLIC WORKS

Published Weekly
by
Public Works Journal Corporation

Publication Office, Floral Park, N. Y.
Advertising and Editorial Offices at 243 W. 39th St., New York, N. Y.

Subscription Rates
United States and Possessions, Mexico and Cuba..$3.00 year
All other countries .....$4.00 year
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Municipal Relief of Unemployment

"Cities and towns must be relied upon for immediate attack upon the emergency created by unemployment." This is the opening sentence of the report of the "Committee on Municipal Organization for Unemployment" appointed by the "President's Conference on Unemployment," made public on October 5. On the same date it was announced that Col. Arthur Woods, who was in charge of finding positions for ex-service men, has been designated by Secretary Hoover to head a special committee for co-ordinating the nation-wide work of relieving unemployment. The report makes some practical suggestions for the procedure of local committees which will probably be published broadcast throughout the country in the daily papers, and should be read and considered carefully by all municipal officials.

We believe that all cities should and will do their parts in relieving the situation by carrying out public work and urging private work. But we believe also that they should bear in mind the President's advice that what is necessary in the present emergency is the stimulating of normal business conditions, and that the mere spending of public funds without obtaining needed returns and value received therefor should not be considered. If those furnishing either material or labor endeavor to take advantage of the efforts being made to increase the amount of public work by demanding abnormal wages or prices, then work requiring such materials and labor should be eliminated from the program until the demands become reasonable.

Some officials already have taken such action. This spring the governor of Illinois refused to endorse the awarding of new contracts for state construction of concrete roads because he believed that the price asked for cement was too high, and in many other localities similar action has been taken. Bradstreet's reports wholesale commodity prices on September 1 as averaging 20 per cent above those of 1913, and the Department of Labor 52 per cent; therefore a charge for any commodity that is more than 30 to 50 per cent above the 1913 prices may be considered as exceeding the present reasonable rate, and there is presumably profiteering somewhere in its manufacture or marketing.

The same is true of labor. The average wages for common labor in New York state are 84 per cent higher than in 1914, and those of skilled labor are 100 per cent or more. Until wages are reduced to not more than 50 per cent above the pre-war basis, the laborers have no reason for complaint if work is not abundant. In some cities of the New York district wages of carpenters and other skilled labor have actually been increased during the past month as the result of an all-summer strike. We believe that the demands of labor for the maintenance of wages at a level higher than the present normal for basic commodities is largely responsible for the present unemployment, sharing this responsibility with the dealers in building materials who are holding the prices of such materials at an average of 100 per cent above pre-war prices.

We do not wish to dissuade any city from doing all the public work that it is possible to do to advantage—we urge them all to do so, in fact. But labor and dealers in materials should do their part and be reasonable in their demands; and if any are not, preference should be given, in deciding upon what work to do, to those willing to sell their services and products at a rate no higher than the present normal.

A notable illustration of what can be done is offered by Pittsburgh. The Bureau of Engineering of that city reports to us that it "has been endeavoring to get all public work possible under contract in order to relieve the unemployment situation, and to date approximately $7,000,000 of public improvements (representing physical cost) has been placed under contract. . . . The construction program, so far as possible, is being formulated to permit as much work as possible to be carried on during the coming winter, giving preference to such classes of work as can be started during the near future. . . . During the winter, excavation contracts will be continued and likewise sewer contracts, and the work on

some of the bridges . . . will be proceeded with. . . . **Labor is at 25 and 30 cents.** Union carpenters have just accepted a new rate of $1.00 per hour. The present condition of the labor and material markets is considered very favorable to the prosecution of public works contracts."

There is hardly a community that has not deferred some needed public work until conditions should become more favorable. If even a part of this deferred work be begun at once, there will be labor for all who will accept it, both directly on these works and indirectly in manufacturing materials and appliances for use on them.

Water Purification at Toledo

Insufficient basin and filter capacity prevent successful use of iron and lime coagulation. Sand incrusted and tastes and odors excessive. New filters now in use.

In the annual report of the Division of Water of Toledo for the year 1920, Water Commissioner George N. Schoonmaker transmits the report of R. W. Furman, chemist in charge of the water purification works, which contains a number of interesting items. During the year 22 new filters were added to the existing plant, these relieving a situation which was becoming serious. During the first ten months of the year the existing filters were taxed to their capacity, the daily pumpage repeatedly exceeding their normal capacity of 34 million gallons. Filter washing was necessary each day and, although algae and similar organisms were not present in such abundance as during 1919, much difficulty was met in supplying enough water.

During January and part of February aluminum sulphate was used as a coagulant. Throughout this period the hardness of the water was the highest on record and complaints were numerous concerning both the hardness and an intense taste and odor that persisted from November, 1919, until April, 1920. Although the taste in the filtered water was decidedly less than in the river water, the hardness on the other hand was greater, reaching 425 parts per million in February, when an iron and lime treatment was substituted for alum.

FILTER INCRUSTATION FROM IRON-LIME TREATMENT

The change in treatment, however, only accentuated the trouble from tastes and odors, but was continued for two weeks, when the spring breakup and heavy precipitation combined with melting ice and snow give some relief in both hardness and taste. Through the latter part of February and the greater part of March alum was used again and the tastes and odors gradually disappeared entirely. For the remainder of the year a moderated iron and lime application was used. On account of the prohibitive price of alum, it was impossible to change back to this material in October, as has been customary heretofore.

It has been found in this plant that by the continued use of iron and lime for about nine months the sand becomes incrusted to the extent of approximately 5 per cent, but these deposits have in previous years been removed without difficulty by using alum for the succeeding three months. This difficulty with using iron treatment is increased in winter because of the low temperature and the fact that insufficient basin capacity does not allow time enough for the proper reactions necessary with the iron-lime treatment.

The effect of an iron-lime treatment when the temperature has fallen below 5 degrees Centigrade was apparent during the latter part of November, when the incrustation of the sand increased rapidly. The treatment was so regulated that the normal carbonate alkalinity of the filtered water would not exceed 6 to 8 parts per million, but complete reaction did not occur until filtration, when the normal carbonate alkalinity was reduced as much as 35 parts per million and the resulting incrustation on the sand reached 30 per cent in a little over two months. It was found that in another plant using water from the Maumee river (the river from which Toledo draws its supply) the incrustation was but 4.5 per cent in December, although the same iron and lime treatment was used; but in this plant the period of sedimentation averaged 15 hours. This experience seems to indicate decisively that more basin capacity is needed at the Toledo plant if iron and lime are to be used during the cold months of the year, and Commissioner Schoonmaker, in his report, recommended that arrangement be made for the construction of a 10,000,000 gallon sedimentation basin (which had already been planned) when the condition of the bond market is favorable.

For treating 10,300 million gallons of water during the year there were used 533 tons of alum, 1,818 tons of iron, 1,583 tons of lime, 8.3 tons of chlorine and 10.3 tons of hypochlorite.

TASTES IN THE WATER

During the year two complete investigations were made jointly by engineers of the State Department of Health and by the Toledo laboratory because of complaints of tastes and odors in the filtered water. Chemical and bacterial analyses were made of the river water at intervals of a few miles between Toledo and Defiance. Because of the fishy taste, consumers insisted that there must be tons of dead fish in the river which were polluting it, but inquiries failed to disclose any evidence of a collection of fish at any point in the river. Investigation did establish, however, that the tastes were not of a harmful nature but were prevalent in dozens of cities in that section at that time and were probably due to algae. Numerous tests showed that the dissolved oxygen content of the river water at this time reached as low as 34.5 per cent saturation.

WATER WORKS FINANCES, LABOR AND METER RATES†

City and state	Private or municipal	Present wages of common labor	Hours per day	Wages of common labor in 1914	Hours per day	Present meter rates: f-per 100 cu.ft.; g-per 1,000 gals.*	Meter rates* in 1914	Operating costs in 1920 per 1,000,000 gals. of water delivered	Operating costs in 1914	Method of meeting increased costs of last three years	Has plant lapsed in condition or capacity because of finances
Montana:											
Havre	M	$4.00	8	$2.50	8	.23f; .30g	.23f; .30g	$85.00	$45.00	Drawing on surplus	No
Libby	P	3.60	8	3.00	8	no meters	....	....	....	Cutting force	Yes
Nebraska:											
North Platte	M	.50	9	.25	10	.....	.15-.05g	....	....	Increased rates	No
Nevada:											
Carson City	P	5.00	8	3.00	8	.29-.05g	.25-.05g	....	....	.....	No
New Hampshire:											
Goffstown	M	4.00	9	3.00	10	.15f	same	....	....	From city treasury	No
Pembroke	M	3.00	9	1.75-2.00	9	no meters	....	....	....	Curtailing in every possible way	Somewhat
Walpole	P	.40	..	.22	..	.30f	.30f	....	....	Surplus	No
New Jersey:											
Belmar	M	4.00	8	2.00	9	.17½f; .23 1-3 g	.17½f; .23 1-3g	.12½	.08	.....	No
Burlington	M	3.00	8	1.50	10	.25g	.10g	50.00	30.00	Using surplus	Yes
Chatham	M	4.00	8	2.75	9	.....	25% less	153.86	101.03	City treasury, surplus	No
Irvington	P	4.32	9	1.80	9	.....	.22f; .30g	....	....	Revision of rates	No
Milltown	M	.50	8	.20	10	.25g	.25g	46.00	33.00	Taxes	No
New Mexico:											
Roswell	M	3.50	8	2.50	8	1.00-.07g	same	80.00	70.00	Cutting force; surplus	Yes
New York:											
Buffalo	M	3.90-3.00	8	2.00	8	.10-.04	.06-.02g	19.05	12.36	Water revenue, bond issues	No
Catskill	M	3.50	8	2.25	8	.10f	.10g	....	....	Increased rates	No
Fort Plain	M	4.00	10	1.50	10	.17f	.17f	....	....	.....	No
Frankfort	M	.40	9	.17½	9	no meters	....	....	....	.....	No
New York	M	5.00	8	2.50	8	.10f	.10f	....	....	City treas., reducing consumption	Somewhat
Potsdam	M	.40	8	.25	8-10	flat rate	....	....	....	Earnings	No
Sag Harbor	P	.40	..	.20	..	.40-.20g	.40-.20g	50.87	25.44	From revenues	No
Troy	M	4.00	8	2.00	8	0.05g	0.05g	17.37	16.70	By economy	No
Westfield	..	.40	10	.20	10	.10g	.10g	....	....	Water funds	No
North Carolina:											
Monroe	M	2.00	10	1.25	10	.50g	.50g	....	....	Raising rates & reduc. consumption	No
Salisbury	M	2.00	10	1.50	10	.30-.07g	....	72.00	....	Raised rates	No
Washington	M	2.00	10	1.25	10	.30-.08f	same	25.00	20.00	Drawing on surp. & raising rates	....
North Dakota:											
Mandan	M	.40	8	.50-.60	10	.26½f; .40g	same	45.83	same	Cutting force, no extensions	No
Ohio:											
Fostoria	M	.45	8	.35	8	.....	1.52-.52½ per mo.	82.00	61.50	Increase in rates	No
Huron	M	4.00	8	2.70	9	.15f	flat rate	....	....	Funds from treasury	No
Milan	M	5.00	10	3.00	10	.10g	.10g	60.00	60.00	.....	No
Mt. Gilead	..	3.00	10	2.50	..	.25g	....	....	....	.....	....
Oberlin	M	4.00	8	....	..	.28-.187f	.22-.15f	202.71	89.91	Drawing on surplus	Yes
Orrville	M	.50	9	.40	9	.25f	.20f	35.00	35.00	Increasing rates	No
Piqua	M	.40	8-10	.25	8-10	no meters	....	....	....	Increased revenues	....
Oklahoma:											
Hartshorne	M	4.00	10	2.00	10	1.00f	.75f	....	....	Increase in rates	No
Oregon:											
Ashland	M	4.00	8	2.25	8	.16 2-3f	....	....	....	From water receipts	No
Grant's Pass	P	.50	8	.40	10	.40-.06½f	same	102.00	118.80	.....	....

*When rates are on sliding scale, the highest and lowest are tabulated when reported. †Concluded from page 262.

Water Works Finances, Labor and Meter Rates

City and state	Private or municipal	Present wages of common labor	Hours per day	Wages of common labor in 1914	Hours per day	Present meter rates: f-per 100 cu.ft.; g-per 1,000 gals.*	Meter rates* in 1914	Operating costs in 1920 per 1,000,000 gals. of water delivered	Operating costs in 1914	Method of meeting increased costs of last three years	Has plant lapsed in condition or capacity because of finances
Pennsylvania:											
Clearfield	P	3.15	9	1.75	10	.20-.04g	same	....	....	Increased consumption	No
Elizabethtown	P	3.00	10	4.00-5.00	10	.09-.25g	same	75.75	same	Drawing on surplus	No
Gettysburg	..	$4.00	10	$1.75	10	.14-.25g	.12-.25g	....	....	Increasing rates	No
Lansford	P	.52½	9	.22½	9	.40-.35g	....	....	....	Increased rates	No
Norristown	P	4.00	10	1.75	10	.20-.05f	same	$85.00	$73.00	Cutting force, drawing on surplus	No
Watington	M	.35	10	.25	10	.08g	....	....	....	.....	No
West Newton	P	.50	9	.25	9	.50g	....	....	....	Increased rates	No
Rhode Island:											
Providence	M	.52	9	.19½	9	.15f; .20g	same	55.00	44.60	From water receipts	No
Woonsocket	M	.40	8	....	..	.21f	....	....	....	.....	....
South Dakota:											
Aberdeen	M	.50	9	.22½	10	.15g	.15g	....	....	.....	No
Tennessee:											
Columbia	..	2.00	10	1.00	10	.35g	....	....	....	Increased rates	A little
Fayetteville	M	2.50	10	1.50	10	.60-.11f	.40-.08f	gravity	gravity	.....	No
Greeneville	M	3.00	10	1.50	10	.25g	....	....	....	.....	No
Johnson City	M	3.00	10	1.25	10	.37-.5+g	....	....	....	Increased rates and business	No
Texas:											
Longview	M	2.50	8	1.25	10	.45g	.20g	240.00	150.00	Increasing rates	....
Sulphur Springs	M	2.00	8	1.50	10	.20g	.15g	....	....	Cutting force	Yes
Waco	M	2.50	8	1.75	8	.....	....	.09		Less improvements	Yes
Utah:											
Murray City	M	3.00-3.75	8	2.75	8	.10g	.10g	....	....	From treasury	....
Vermont:											
Barre	M	3.50	8	....	..	.20-.03f	.16-.08f	....	....	Reducing extensions	Yes
Barton	M	3.00	9	1.50	10	no meters	....	....	....	.....	No
Montpelier	M	3.50	9	2.00	9	.10f	same	....	....	Surplus	No
Virginia:											
Lexington	M	3.00	10	1.50	10	.25g	.25g	gravity	gravity	Increased consumption	No
Washington:											
Auburn	M	4.00	8	2.50	8	.15f	.25f	122.80	....	Increased consumption	No
Cle Elum	M	6.00	8	2.50	8	.06-.10g	same	....	....	Raising flat rate	No
Ellensburg	M	4.50	8	2.50	8	.13g	flat	32.20	....	Drawing on surplus	Yes
Wisconsin:											
Janesville	M	.40	9	.25-.30	9	.....	10 per M	60.04	18.60	Bond issues	No
Lake Geneva	..	5.00	9	4.00	9	.35	same	....	....	.....	No
Monroe	M	3.50	10	1.50	10	.25-.07f	same	....	....	.....	No
Wyoming:											
Sheridan	M	4.00	8	2.00	10	.11-.04f	....	....	....	City treasury	....
Ontario:											
Toronto	M	.60	8	.28	9	.13¾g	.10-.07½g	1.05	.83	Increased rate	No

*When rates are on sliding scale, the highest and lowest are tabulated when reported. a—1916. b—1915. c—1917.

How to Be a Successful Engineer

Advice by one of the deans of the profession, naming what he considers to be the five most important elements that contribute to an engineer's success.

At the installation of a student chapter of the American Society of Civil Engineers at Purdue University, Prof. Ira O. Baker delivered an address to the students which contains in brief and forceful language much advice that should be helpful not only to students but also to all the young men in the engineering profession. Our space will not permit us to give the address in full, but we have endeavored to give the gist of it in the excerpts quoted below. We believe that every engineer would benefit by reading these, and still more by reading the complete address.

"What are the most important elements that contribute to the success of an engineer? They can be included under five heads, namely: (1) technical ability; (2) breadth of knowledge; (3) initiative; (4) executive ability; and (5) ability to write and speak clearly and forcefully.

"1. **Technical Ability.**—Apparently, in the past at least, the chief aim of the engineer has been to perfect himself in technical details. Many, if not most, engineering instructors have been impressed with the magnitude of the field of engineering knowledge, and have given their best efforts to imparting to their students what they believed to be the technical information needed in their future work. Therefore, the chief aim of the engineering student has been naturally, and almost universally, to acquire facts about his chosen profession. . . . In various ways the profession is now seeking to overcome this handicap.

"What may the engineering student do to correct this mistake? First, he must be thoroughly convinced that the mere accumulation of technical information has little or no educational value. He should never overlook the fact that the power to observe closely, to reason correctly, and to state clearly are of vastly greater importance than any amount of technical information; and he should not forget that technical details without these qualities are absolutely useless. Technical details speedily get out of date; but these qualities are never out of date, and are always valuable whatever a man does. . . .

"The power to acquire information, and the knowledge of how to use it, is of far greater value than any number of the most useful facts. I repeat that the accumulation of facts is practically worthless.

"2. **Breadth of Knowledge.**—The second factor I mentioned as necessary for the success of an engineer is breadth of knowledge. The engineer should understand at least some of the fundamentals of economic problems, of social conditions, or political questions, of legislative action, and know something of the subtle relations of labor and capital, of the factors affecting international trade, and of other questions that form the subject of the thinking and conversation of his business associates and other professional men. If the engineer is found seriously lacking in knowledge of these subjects, the layman considers him an ignorant man. . . .

"One of the best means of broadening his horizon is to read regularly and systematically a good technical journal; but an engineering student, in addition to keeping an eye on the less transient and less ephemeral articles of a good daily paper, should also read the political or governmental or financial articles in at least one of the standard monthly magazines.

"3. **Initiative.**—The third important factor in the preparation of an engineer is initiative. The most successful engineer must have the ability to devise new solutions of an old problem, the power to discover new methods of accomplishing results, the capacity to find ways and means without waiting to be told. Without the power of initiative the power of self-direction, no one can hope to be trusted with large responsibility. Men who are at the head of large enterprises and who carry large responsibilities are always looking for those who have initiative; and not infrequently they choose the uneducated man, or perhaps I should say the unschooled man, who has the power of initiative, in preference to the college trained man who does not have it. . . .

"The cultivation of the power of initiative, of self-reliance, of self-direction is the most important phase of a college education. If a student has a problem which baffles him, he should not be content to lay it aside with the expectation that the instructors will explain it at the next recitation; but he should regard such a problem as a challenge to his intellectual power, to his ability to overcome obstacles, and he should earnestly, even enthusiastically, wrestle with the difficulty until he has overcome it. . . .

"5. **Ability to Write and Speak.**—Fifth, and last, I come to the consideration of one of the most serious mistakes, if not the most serious of all the mistakes, engineers have made in the past. The engineer, in college and also after graduation, has been so intent upon perfecting himself in technical details that he has neglected the means of communicating his thoughts by writing or speaking to his fellow men. The engineer, if he is to attain to any considerable prominence or influence in his community, must do business with other men, must explain plans, must write letters, must prepare contracts, must give testimony in court, must write reports; unless he has acquired the ability to express his thoughts in clear and forceful English, he cannot influence others to accept his views, or convince others that he is an intelligent or educated man. Other men are not able to judge him by his technical attainments, but do judge him by his ability in writing and speaking. Unless he uses clear and forceful language, others are likely to assume that he is an ignorant man, and consequently his professional standing suffers and his influence as a citizen is weakened. . . .

"I firmly believe that some engineers by their crude, confused and incorrect speech discredit all engineers and do much to prevent the recogntion of engineering as a profession. Such men are in a large degree responsible for the low pay and lack of honorable recognition of engineers.

"Of the five qualifications I have discussed, the ability to write and speak clearly and forcefully is the one most easily obtained and the one that is most important in its effect on the success of the engineer. That is a pretty strong statement, but in my opinion it is strictly true."

Summer Use for Snow Plows

Like most other northern cities, Buffalo, N. Y., is provided with snow plows that can be attached to the front end of trucks or tractors to be used in removing snow from the city's streets. The trucks or tractors so used are presumably in service throughout the remainder of the year on work for which they were regularly designed, but the plows themselves have been stored, except during the few days of the year when snow removal is necessary. The street department of Buffalo uses Champion snow plows, some of them at least being attached to Bates "steel mule" tractors.

Early in the spring of this year W. F. Schwartz, street commissioner of Buffalo, decided to try the use of the city's snow plows in distributing ashes and rubbish on the lake shore dumps, where the city is reclaiming land—work which heretofore had been performed by scrapers hauled by city teams and by men spreading the refuse by hand shovel. A tractor with snow plow attached was started on this work in March and has been used continuously since that time, working almost continuously with very few delays or interruptions. Commissioner Schwartz recently stated that this plan, which is in direct charge of Mr. Kilgallon, of the department of streets, "has worked out very satisfactorily and we are more than pleased with the work done."

The loads of rubbish are dumped on the top of the fill near the edge and are pushed forward by the machine. The plow being hung in front of the machine, the material can be shoved to and beyond the edge, which is impossible with a horse-drawn scraper. Moreover, it can be spread more quickly and to better advantage, as well as more cheaply.

During the last of August and the first of September a ten-day test was run by Mr. Kilgallon. During this time the number of loads spread per day varied from 45 to 60, each load containing about 5½ cubic yards. The amount of gasoline used was 4 gallons per 8-hour day, but 7 is required in winter work. The amount of oil used was 2½ quarts per day and 2 gallons per week of heavy transmission oil. During the six months the cost of repairing and overhauling the tractor has been $50, while practically none has been required for the snow plow. It required two men to handle the machine, one running the tractor and one to handle the plow.

The plow performs work previously done by a team drawing a scraper and four men. As the equipment would otherwise be lying idle, any operating profit obtained by this use reduces by that much the overhead of snow removal work.

Pennsylvania's Improved Highways

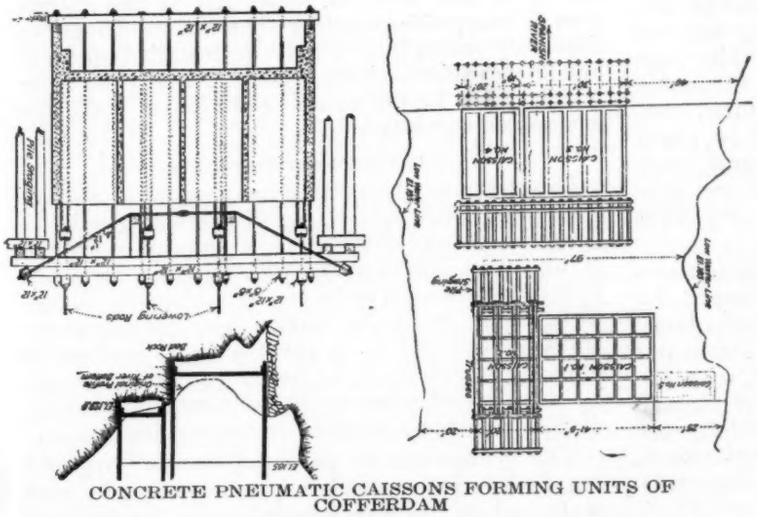
Prior to 1919 there were in the state of Pennsylvania 3,800 miles of improved highways, an amount which at the end of the present year will have been increased by 1,150 miles improved since 1919 and 200 miles that will have been completed by the end of this season, making a total of 5,250 miles; to which it is stated by Lewis J. Sadler, Pennsylvania State Highway Commissioner, that 1,000 miles more should be added in order to provide a system of roads serviceable for the entire state. Under present conditions it is now possible to drive 1,000 miles over continuous hard-surface roads in the state of Pennsylvania. An up-to-date comprehensive system of construction has been developed and should be continued, eventually becoming chiefly one of maintenance.

SNOW PLOW USED TO SPREAD REFUSE ON PUBLIC DUMP BY CITY OF BUFFALO

Crib and Cofferdam Work III*

Pneumatic caisson cofferdams for dams and for excavations in quicksand. Correction of leaks in cofferdams. Unwatering cofferdams by pumping and draining. Permanent construction cribs.

In some cases where great strength, accuracy or permanence is required or where the bottom is such that it is extremely difficult or impossible to seal ordinary cofferdams on it and make a watertight joint with the surface of the ground and sheeting cannot be driven or core-walls placed, cofferdams have been made with pneumatic caissons, which it is not only possible to sink under all possible adverse conditions, but which can be bonded together by forming efficient construction joints between them and making a continuous solid wall of any required length and dimension. A pneumatic caisson cofferdam has the additional advantage of being fitted to horizontal bearing on the earth or rock below the surface and thus securing great resistance against transverse displacement. Generally when pneumatic caissons are used for cofferdams the design is such that they subsequently form part of the necessary permanent structure.



CONCRETE PNEUMATIC CAISSONS FORMING UNITS OF COFFERDAM

Pneumatic caissons have been used in the construction of cofferdams for the unwatering of river channels to prepare the site for permanent dams. An example is in the St. Maurice river, Canada, where the water was very deep and swift and the river bed was of jagged rock deeply covered with large loose boulders. Some of these were removed so as to permit a portion of the dam to be built inside crib cofferdams and the remainder, where the cribs could not be located, was built with pneumatic caissons arranged to form the foundations for the upper and lower toes of the permanent concrete dam, but having a space between them that was unwatered and excavated by hand to provide for the placing of the mass concrete that formed the remainder of the foundations of the dam inside the limit of the crib cofferdam. In this case reinforced concrete was used for the construction of the caissons, which were built on platforms suspended from temporary towers and gradually lowered to the bottom of the river by slacking off the nuts on vertical rods by which the caisson was suspended from falsework trusses.

FOR FOUNDATIONS OF BUILDINGS

Important examples of the use of pneumatic caissons for cofferdams are seen in the construction of the substructures for very tall and heavy office buildings in New York, where they are located on fill and quicksand up to 100 feet or more in depth overlying hardpan and solid rock. The foundations are carried through the strata to rest on rock by the pneumatic caisson process, which is applied to the construction of the concrete piers supporting the columns in the outer walls of the building. These caissons are steel, wood or generally at present of reinforced concrete, are made comparatively long, narrow and high, and are sunk close together end to end, to make a sectional wall continuous around all sides of the lot or enclosing sides not previously enclosed by similar constructions or existing buildings.

These caissons, sometimes extended by detachable cofferdams on top, are sunk into the rock and the spaces between them are cleared of the quicksand and earth and are filled with concrete extending into cavities at the ends of the caissons, thus bonding the adjacent caissons together with watertight joints and forming in reality subterranean cofferdam with the top, or at least with a detachable cofferdam on top, reaching above ground water level and frequently still higher to the temporary surfaces of the general excavation, which is later depressed. As the cofferdam prevents the flow of water and quicksand into the space enclosed by it, this, being a relatively small area, can be easily unwatered and the remaining operation of heavy excavation, concreting, waterproofing and erection, is advantageously carried on and the interior piers are thus built much more cheaply in the open than they could be by the pneumatic process. Eventually the excavation is completed inside the cofferdam and as it is carried down tremendous unbalanced pressure of the semi-fluid mass on the exterior causes a great horizontal thrust that must be resisted by a system of very heavy temporary cross struts of large timbers from 10 to 20 feet apart horizontally and 5 or 6 feet apart vertically, which are finally replaced by the beams and girders in the permanent floor system.

LEAKS

When leaks occur through earth cofferdams it is generally because the material is inferior or inadequate and more material has to be dumped

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on the outer space of the cofferdam to close the leaks. For this purpose clay is the best, but if the leak is very large or if an opening has actually been made in the cofferdam there may first be placed a quantity of broken stone or any convenient material covered with earth and later with clay. Sometimes, too, it may be advantageous to sink a large piece of canvas in a horizontal position over the suspected leak and cover it with a heavy bed of earth and clay.

If the leak occurs at the outer toe of the cofferdam it may be often remedied by enclosing it with a line of sheet piles. Although these piles are not at first absolutely watertight they will shut off any considerable flow of water and may eventually become tight.

Leaks through wooden sheet piling may be stopped either by an embankment against the outer face or by driving additional piles parallel to the existing piles and filling the space between them with puddled clay.

Leaks through steel sheet piles often occur in the clearances of the installation joints and are likely to gradually silt up, but if the water is very clear or for any other reason setting up does not take place, they may be sometimes closed by driving long wooden splines in the joint if the clearance is sufficient or sometimes by injecting grout into the joints. When the piles are broken or when they are obstructed so as not to be driven to the required depth another row may be driven parallel to them.

Sometimes relief of leakage may be had by divers examining the leaks and depositing bags of sand and concrete to fill the cavities. The bags should be only partly filled in order to enable them to mould themselves to the required contours and if the concrete is deposited in paper bags the paper may or may not disappear later. If deposited in burlap bags it generally will penetrate through the fibers of the fabric and form cemented joints with adjacent bags.

Large leaks in the vertical faces of cofferdams may sometimes be examined and stopped by means of small auxiliary movable cofferdams, called suckers, with three sides and a bottom but open on the fourth side and top and with the vertical edges provided with gaskets, which may be lowered alongside the face and held by the water pressure against the face of the cofferdam. Such cofferdams are frequently used in shipyards.

INTERIOR BOTTOM LEAKS

The most serious leakage into cofferdams is upward through the bottom where the ground is porous or where the bottom is of rock with seams and fissures. It is always difficult and sometimes impossible to control. In rock bottom it may be possible to drill rows of holes in the cofferdam and even outside of the cofferdam, piercing the water-bearing strata or rock seams, and through these holes force grout in successive applications until it has closed the seams and shut off the flow of water. This method was successfully adopted in the construction of the Olive Bridge dam and of a cofferdam in the Ohio river.

Generally where separate leaks are disclosed inside the cofferdam, sumps or wells are excavated around them and the suction of a powerful pump is introduced to draw the water away if possible. In other cases, if the leak is sufficiently concentrated, it may be enclosed with a watertight well or shaft or a vent pipe sealed into it and the water allowed to rise freely and overflow over the top of the cofferdam.

Experiments have been made to close leaks in the bottom of an area of a cofferdam by means of the freezing process applied by the circulation of cold air through pipes in trenches or on the bottom. This method is, of course, extremely slow and very costly and probably will never be resorted to unless under extreme conditions. The circulation of brine requires a somewhat smaller installation but is likely to defeat its own object, since if leaks occur in the pipes the escaping brine prevents local freezing. The circulation of compressed air is little injured by leakage, for this causes expansion and increased refrigeration.

When the leaks are very numerous or very strong, it is often advisable to subdivide the cofferdam by interior partitions of the same character as the outside cofferdam or of different nature, as may prove desirable, and then concentrate all of the unwatering efforts on one division at a time, thus completing the excavation and generally affording an opportunity to concrete the bottom and seal the leaks so as to successively progress over the entire area. It is sometimes advisable to anticipate this method, especially if the cofferdam is composed of piling that can be driven so that only enough of it may be installed to form one or two subdivisions of the cofferdam and from which it can be pulled and redriven to make the successive sections.

UNWATERING COFFERDAMS

Unwatering the cofferdam is almost always performed with pumps, but if the topography is favorable it may sometimes be done by a syphon or by direct drainage through pipes or canals to disposal at the lower level. If syphoning is possible, the pipes can be carried over the top of the embankment and to as great a depth and for as long a distance as is necessary, provided the outlet is sufficiently below the bottom of the cofferdam to provide a head to overcome friction.

The syphon can be put in operation by pumping or by closing both ends and filling it with water while the air escapes at the summit. If pipes are inserted through the cofferdam, great care must be taken to protect the latter from leakage around them, especially in earth embankments where any leakage would be sure to cause serious scouring and where the pipes inserted should be built in as the cofferdam is constructed and provided with cross walls, stops, and proper facing to protect the intake.

Pumping for very small cofferdams may be accomplished with hand diaphragm pumps if the lift is low and the cofferdams and bottom are tight. Usually, however, power pumps will be necessary, and for small work or where the leakage is light,

these may be of moderate size and driven by gasoline engines. For large cofferdams or heavy leakage or long-continued work it will be necessary to install plunger or centrifugal pumps operated by steam or electric power.

Usually centrifugal pumps are the simplest and most efficient and give very good service for ordinary lifts and large volumes of water. Sizes of 2 to 6 inches, according to the magnitude of the work are generally used, although 8 and 10-inch pumps are occasionally installed. The pumps may be used singly for different sumps or they may be combined in batteries in two or more sumps. Under favorable conditions the cofferdam can be unwatered by constant heavy pumping and then kept dry by operating one or two pumps a portion of the time or one pump constantly working at low capacity.

PERMANENT CRIBS

Cribs are used not only for auxiliary purposes as cofferdams, but for primary construction for foundations of walls, retaining walls, bridge piers, abutments, and other foundations, generally for submerged operations. When used for such purposes they differ little, if any, from the cribs used for cofferdam construction except that they are likely to be filled completely with broken stone or with concrete.

They are built with the bottoms fitted to conform with the profile of irregular rock or with horizontal bottom to be sunk to a level surface or in a dredged excavation. They are sunk by rock or earth ballast and when completely filled serve as a footing for stone masonry or concrete, which always extends below water level and is generally built either in very shallow water just below low water elevation or in detachable cofferdams that are easily maintained on the tops of the cribs and removed after the structure is finished.

Crib foundations are most used in very swift, deep current and on very irregular rocky bottom and for sea walls, quays and foundations that are exposed to heavy wave action. They can be built in safe locations on shore, floated to position under favorable conditions, and can quickly be ballasted and sunk and made temporarily stable to resist displacement before completion of the substructure. When used for bridge piers they are generally filled solid with concrete deposited in their pockets under water by the tremie method or with bottom-dump buckets carefully lowered to position. As they are wholly submerged, no attempt is made to make tight sides and wide interstices are frequently left between the timbers.

Sometimes the crib walls are made of planks laid flat with spaces between them and serve merely as a container for the concrete and to break the force of the current. Recently cribs have been made of reinforced concrete of large dimensions built on shore, fitted with false bottoms, lifted by heavy derricks, launched and floated to position or carried on barges, sunk to the bottom and later filled with concrete. An example of very large concrete cribs is seen in the harbor improvement construction at Halifax, N. S.

Mosquito Control by Use of Top Minnow

Ichthyologist Samuel F. Hildebrand recently made the following report on the prompt control of mosquito production by employment of Gambusia in large numbers, this report being published by the United States Public Health Service in "Public Health Reports."

"Unusually heavy rains were experienced around Augusta, Ga., early in July. As a result, many temporary ponds were formed. A pond, covering about one-fourth acre of ground, was observed on July 18 to contain mosquito larvae in countless numbers. Culicine larvae predominated, but many anopheline larvae were also found. The mosquito larvae were uniformly distributed over the pond. Previous to the July rains this depression was completely dry, but it gave evidence of having been under water for a considerable period of time since aquatic plants, cattails, and arrowheads were well established. Smart weed, Bermuda grass and foxtail occurred along the edges of the water. On July 19, approximately 2,000 Gambusia were introduced. On the evening of July 20 no wiggletails were visible in open water, but they were exceedingly numerous in the vegetation where they had gone for protection. On and after July 26 only an occasional small wiggletail could be found."

As the fish were obtained from an abundantly stocked pond only about 300 yards distant, they were transferred about 500 at a time in a wooden tub, the work requiring less than half a day's time of one laborer. The cost in this instance for complete, prompt and continuous control of mosquito production was not more than $1.

Varieties of Paving Brick

At the request of the United States Department of Commerce the National Paving Brick Manufacturers' Association has, during the past few weeks, been collecting from the various manufacturers of paving brick information concerning the various kinds and sizes of brick which each manufacturer has shipped during the past ten years. It would appear from the blank sent out for the manufacturers to fill in that at least 15 different sizes and types have been in more or less common use, since these are especially mentioned in the questionnaire, while some manufacturers have been asked by purchasers to provide still different ones, we understand.

The several types and sizes specified are as follows: Plain wire-cut brick and block, 8½ inches long, 4 inches deep and either 2½, 3, 3½ or 4 inches wide. Vertical fibre bricks with lugs, dimensions the same as above. Dunn wire-cure-lug brick, 8½ inches long, 3½ inches deep and either 3, 3½, 4 or 5 inches wide. Repressed brick, 8½ inches long and 3 by 4 or 3½ by 5 inches. It is the belief of the Department of Commerce and of the National Paving Brick Manufacturers' Association that it will be to the advantage of both consumer and manufacturer if these various types and sizes be reduced to not more than 3 or 4 instead of the considerable number now in more or less common use.

Recent Legal Decisions

CONSTRUCTION OF NEW JERSEY STATUTE AS TO SOURCES OF MUNICIPAL WATER SUPPLY

In an action as to the validity of a permit granted by the New Jersey state board of conservation to the borough of Wharton to divert water from the Rockaway river to provide a better water supply, the New Jersey Court of Errors and Appeals holds, Fagen v. Mayor, etc., of Borough of Wharton, 113 Atl. 920, that the limitation of the Act of March 16, 1916, par. 18, that it shall be unlawful for any municipality to obtain a new or additional water supply from any watershed other than the watershed or watersheds from which said municipality obtains its existing water supply without the consent of the district water supply commission, the court said, "must be read in connection with the entire act, which has reference to granting permission to any municipality, and the prohibition was not intended to deprive the state board of its special oversight and powers in all cases. If it be otherwise, then the state board is powerless to oversee the acts of the district board. We also think the evidence shows that there is a public necessity for the new supply."

ORDINANCE AS TO REMOVAL OF ASHES HELD NOT DISCRIMINATORY AS AGAINST APARTMENT HOUSE OWNERS

The Maryland Court of Appeals holds, Mayor, etc., of Baltimore v. Hampton Court Co., 113 Atl. 850, that ordinance No. 55 of the mayor and city council of Baltimore, approved December 20, 1915, adding a new section to the Baltimore City Code, 1905, art. 26, to be known as sec. 2-A, making it the duty of the commissioners of steet cleaning to remove all ashes from dwelling houses, apartment houses and tenement houses, with the limitation that such ashes shall not exceed 15 bushels per week, is not capricious, oppressive, unreasonable, or discriminatory, against owners of apartment houses having a larger amount of ashes than their neighbors who do not live in apartment houses. The court said that "it does not seem to be any more unreasonable to require owners of large apartment houses to provide for the removal of their ashes in excess of the amount produced by the owner of large dwe'lings, than to require hotels, factories and department stores producing large quantities to remove the same, as we said in Mayor and City Council of Baltimore v. Hampton Court Co. (126 Md. 341, 94 Atl. 1018), they could be compelled to do."

AUTHORITY REQUIRED FOR PURCHASE OF FIRE ENGINE BY MUNICIPALITY UNDER MISSISSIPPI STATUTE

Under the provisions of chapter 8, par. 43, of the Charter of the City of Columbus, Ohio, as well as under section 3474, Ohio Code of 1906 (sec. 2812, Hemingway's Code), no contract can be entered into by any officer on behalf of a municipality unless "specially authorized thereto by law," or by an order of the board of municipal authorities. The Mississippi Supreme Court holds, Kidder v. McClanahan, that any contract by a municipality for the purchase of a fire engine is not such a contract as the mayor is specially authorized by law to execute for the municipality; and, in order to legally execute such a contract on behalf of a municipality, he must be specially authorized to do so by an order of the mayor and city council entered on their minutes; and such order must either set out the proposed contract in full, making it a part of the order adopting it, or the minutes of the board must show the important and controlling provisions of the contract which he is authorized to sign. The mayor and city council have no right to delegate their power to the mayor to agree on the terms of such a contract.

POWER OF MUNICIPALITY TO ACQUIRE WATER WORKS PARTLY SITUATED IN ANOTHER STATE

On a rehearing of the case of Superior Water, Light & Power Co. v. City of Superior, the Wisconsin Supreme Court, 183 N. W. 254, had before it for consideration the question whether the city could acquire title to that portion of the water company's property situated in Minnesota. The court holds that proceedings on the part of a municipality to acquire the property of a water works company under the Wisconsin Public Utility Law are in the nature of condemnation proceedings, even where the company has voluntarily accepted an indeterminate permit. Although a portion of the property might be physically located beyond the borders of the state, nevertheless, it being deemed personal property, it was held to have a legal status in the state; and therefore the state has ample jurisdiction to deal with the entire property as property within the state and to take the title from the water company pursuant to its power of eminent domain. The city was held to have power to acquire and own water works property beyond the state as well as the city boundaries.

POWER OF VILLAGE UNDER STATUTE TO MAKE FRANCHISE AGREEMENT WITH LIGHT AND POWER COMPANY

The Michigan Supreme Court holds, Village of Plainwell v. Eesley Light & Power Co., 183 N. W. 66, that where a village, pursuant to section 2782, Mich. Comp. Laws, 1915, has made a franchise agreement with a light and power company for a period of 10 years, the power of the village to make such a contract, though exhausted by the making of the contract, was restored by an agreement between the village and the company terminating such contract on the day a new contract was to take effect. Such a contract is not ultra vires as for a longer period than the 10 years authorized by the statute because 5 months and 24 days are allowed the company for preparation and the installation of equipment for performance of the contract.

NEWS OF THE SOCIETIES

October—IOWA SECTION OF THE AMERICAN WATER WORKS ASSOCIATION. Seventh annual meeting, Omaha, Neb. Secretary, Jack J. Hinman, Jr., State University, Iowa City, Ia.

Oct. 1-15—LYONS FAIR FOR PROMOTION OF INTERNATIONAL TRADE. Lyons, France.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 11-14—AMERICAN ASSOCIATION OF PORT AUTHORITIES. Annual meeting. Seattle, Wash. Secretary, M. P. Fennell, Jr., 57 Common St., Montreal, Canada.

Oct. 12-14—LEAGUE OF KANSAS MUNICIPALITIES. Annual convention. Lawrence, Kans. Secretary, John G. Stutz University of Kansas.

Oct. 17—ILLINOIS STATE FEDERATION OF LABOR. Aurora, Ill., Headquarters, 166 W. Washington St., Chicago.

Oct. 20-21—CITY PAVING CONFERENCE. Engineers Club of Philadelphia, 1317 Spruce St., Philadelphia. H. E. Hopkins.

Oct. 20-21—OHIO STATE CONFERENCE ON CITY PLANNING. Annual conference. Columbus, Ohio. Secretary-treasurer—Charlotte Rumbold, Chamber of Commerce Building, Cleveland.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary. Charles Carroll Brown, St. Petersburg, Fla.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan. Devonshire st., Boston.

Nov. 14-16—CITY MANAGERS' ASSOCIATION. Annual meeting. Chicago. Secretary, H. G. Otis, city mgr., Clarksburg, W. Va.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

Nov. 16-18—NATIONAL MUNICIPAL LEACUE. Chicago. Secretary, H. W. Dodd, 261 Broadway, New York City.

Nov. 17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Joint meeting with Society of Naval Architects and Marine Engineers. New York.

Nov. 17-18—SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS. New York.

Dec., 22-23—KANSAS ENGINEERING SOCIETY. Hutchinson. Kan.

Jan. 17-20—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual Convention and good roads show. Chicago, Ill.

AMERICAN PUBLIC HEALTH ASSOCIATION

The fiftieth annual meeting of the American Public Health Association will be the occasion of a Health Fortnight. From November 8-19, New York City, will be the scene of activities connected with this event, and the publicity with its slogan "Health First" will stimulate interest throughout the country.

Health Fortnight will include three major divisions—a Health Institute from November 8-11; a Health Exposition, November 14-19; the Fiftieth Annual Meeting of the American Public Health Association, November 14-19. Representatives from virtually every State in the Union and from many foreign countries will participate in the extensive program.

To focus the attention of the general public upon this celebration, November 13th will be observed as Health Sunday in many churches. Health Day will also be observed in the synagogues and in numerous business and social organizations. Speakers prepared to talk authoritatively on health topics will be furnished on request to any of those organizations. The New York County Chapter of the American Red Cross is co-operating with the general committee in the arrangement for this service.

The Public Health Exposition will undoubtedly make the widest appeal to the lay public. It will be the largest affair of its kind ever held in New York City. It will be conducted under the joint auspices of the Department of Health of the City of New York and the American Public Health Association. Already allotments of space indicate that at least two entire floors of the Grand Central Palace will be occupied by exhibitors. The exhibits will include those of educational and philanthropic organizations and those of commercial houses producing approved articles of health value.

Every legitimate means will be utilized to promote attendance at the Exposition, for this will be the most effective way in which the message of Health Fortnight may be brought to the public. The fact that a similar health exposition held in Chicago a year ago drew an attendance of over one hundred thousand indicates the extent to which this form of popular education may be carried. Naturally, in New York with its larger population, a proportionately greater attendance is expected at the Exposition. The profits from the sale of tickets, after the cost of the Exposition and the Convention are defrayed, will be devoted to establishing nutritional clinics for the benefit of undernourished children. In this connection, Dr. Royal S. Copeland, Health Commissioner of the City of New York, will present a series of educational exhibits in which instruction in the feeding of children will be featured. Dr. Copeland is chairman of the Exposition; A. W. Hedrich of the American Public Health Association is Secretary and Dr. C. E. North, treasurer and general manager.

The Health Institute from November 8-11, will present to visitors to the Convention an unusual opportunity to see the operations of established methods applied to various phases of public health work. About forty demonstrations have been planned. The thoroughness of the program may be gathered from the fact that the Institute is sponsored by the American Public Health Association, the Health Department of the City of New York, the New York State Department of Health, the U. S. Public Health Service, the National Health Council, and the Committee on Public Health of the New York Academy of Medicine, with the co-operation of approximately one hundred other organizations. The chairman of the committee in charge is Dr. W. E. Evans. The Director of the Institute is Dr. D. B. Armstrong of the National Health Council.

PERSONALS

Marsh, Robert S., of Alliance, Ohio, has been made state architect and engineer of Ohio, and will be connected with the department of highways and public works.

Hutson, W. F., is now district engineer of the Texas state highway department at Waco, Texas.

O'Donnell, James E., has accepted a temporary position as city manager of St. Albans, Vt., to fill the vacancy due to the recent resignation of Athole B. Edwards.

Keller, Col. Charles, Corps of Engineers, U. S. Army, has been appointed enginer-commissioner of the District of Columbia, succeeding Col. Charles W. Kutz.

Sheets, Frank T., until recently engineer of design in the division of highways, Illinois Department of Public Works, has been promoted to the position of superintendent of highways, which position was formerly held by S. E. Bradt, resigned.

Bennett, J. B., has been appointed county engineer, Pottawatomie county, Okla.

Ullins, F. W., Jr., city engineer of Shorewood, Wis., has been appointed member of the Metropolitan Sewerage Commission of Milwaukee county. The other members of this commission are Charles B. Perry and George P. Miller.

Smook, Joseph M., has been appointed aid with the U. S. Coast and Geodetic Survey and is now located in Wisconsin.

Foulks, John A., assistant chief examiner of the Civil Service Commission, has been appointed by Director Raymond of the Department of Streets and Public Improvements, Newark, N. J., to head the new division of water in this department, with the title of chief engineer of that division.

Barstow, E. D., head of the department of county sanitary engineering of Summit county, Ohio, who, upon the abolition of the department by the county commissioner, lost his position, has been re-hired as sanitary engineer, effective October 1st.

Smith, R. Home, has been unanimously chosen by the Toronto Harbor Commissioners as their chairman, to succeed the late Hon. Lionel H. Clarke.

Valiquette, J. H., was recently appointed manager of the city of Shawingan Falls, Quebec.

Rochetti, J., chief engineer of the Manitoba Power Commission, has been appointed power commissioner for the province of Manitoba, succeeding J. M. Leamy, who resigned.

Dickerman, Alton L., 71 years old, well-known mining engineer who represented John D. Rockefeller in the development of iron mines in Minnesota, died at Colorado Springs, Colo., on September 15th.

Black, Tanjor, of Whitehall, Mont., has been appointed assistant engineer in the Reclamation Service, and has

reported for duty at Malta, Mont., on the Milk River project.

Richardson, Clifford, well known in this country and Europe as a specialist in asphaltic materials and paving methods, is retiring from active practice on October first. He will leave New York City, where he has been engaged as consulting engineer for the Barber Asphalt Paving Co., for Santa Barbara, Cal.

Ward, Robert L. E., has been appointed city engineer of Canon City, Colo.

Smith, Prof. L. S., head of the highway engineering and city planning courses of the university of Wisconsin, has been appointed engineer of the Appleton, Wis., city plan commission.

Conner, R. M., has been transferred to the Riverton project, U. S. Reclamation Service, as construction engineer on diversion dam and canals to irrigate 100,000 acres in Fremont county, with headquarters at Pilot, Wyo.

Shaner, Harry L., has been re-elected by the board of aldermen as commissioner of public works of Winston-Salem, N. C.

Guepel, Louis A., has been appointed sanitary engineer in charge of the Indiana state water and sewage laboratories to succeed John C. Diggs, who has been transferred to the State Conservation Department.

Luedke, A. L., engineer-eonomist of the U. S. Bureau of Public Roads, Washington, D. C., has been transferred to St. Paul, Minn.

Bailey, Paul, has been made chief deputy to W. F. McClure, state engineer of California.

Stephens, U. S., has been appointed county engineer and road superintendent of Runnels county, Texas, to have charge of all road work.

Carter, V. H., formerly chief designing engineer, has been appointed acting harbor engineer in charge of port development, maintenance and reclamation for the Port of Oakland, Cal.

Thomas, E. R., has been appointed city engineer of Port Arthur, Texas.

O'Connor, John, has been appointed superintendent of construction of the municipal water works of Fort Wayne, Ind.

Howe, S. B., has been appointed city engineer of Sioux Falls, S. D., and F. J. Connor has been appointed superintendent of water works.

Eakin, Jacob, formerly assistant city engineer, has been appointed city engineer of Sandusky, Ohio, to succeed Arthur Johnson, who becomes county surveyor.

Shuff, Carl L., of Spokane, Wash., has been appointed state supervisor of reclamation by the director of the Department of Conservation and Development.

Morgan, Arthur E., has been appointed chief engineer for the Pueblo, Colo., Conservancy District Project.

Niles, Arthur H., formerly assistant city engineer of Jackson, Mich., has been appointed city engineer of Sturgis, Mich.

Clark, B. E., acting state engineer and highway commissioner of Oklahoma, has been appointed state highway commissioner.

INDUSTRIAL NOTES

The Consoer Engineering Co., municipal engineers, 140 South Dearborn street, Chicago, have been appointed engineers for the city of West Hammond, Ill., to succeed W. F. Bridge, former municipal engineer.

C. B. Cole has opened an office at 546 West Washington blvd., Chicago, for the practice of consulting engineering, specializing in tools, gauges, interchangeable manufacture and inspection systems, etc.

The National Distributors' Association of Construction Equipment at its semi-annual meeting at Milwaukee, Wis., on Sept. 12th and 13th changed its name to the Associated Equipment Distributors. Morton R. Hunter, 124 Second St., Milwaukee, is the secretary.

The Northwest Engineering Co. of Green Bay, Wis., has purchased the plant, assets and business of the Northwest Engineering Works, and will now manufacture the "Northwest" crane.

The Wood Hydraulic Hoist & Body Co., of Detroit, Mich., has just opened what is considered the largest plant in the world devoted to the manufacture of steel and wooden truck bodies. A separate department has been set aside for the construction of a new Ford power dumping unit, using in its construction a miniature hydraulic hoist.

The American Steel and Wire Co., Chicago, has appointed H. S. Durant sales agent, and M. W. Floto, assistant sales agent, at the Detroit office of the company, to succeed M. Whaling and T. J. Usher, Jr., resigned.

Dwight P. Robinson & Co., engineers and contractors, New York, have been retained by the Brazilian federal government in connection with its plans for the reclamation of its semi-arid states, whih work will include the construction of five large dams, creation of storage reservoirs, etc.

The National Paving Brick Manufacturers' Association has appointed Stanley A. Knisely as economist, and through his department the association will intensify its studies of brick pavement service from an economic standpoint.

A. C. Anderson, formerly mechanical engineer with the Putnam Machine Works of Manning, Maxwell & Moore, of Fitchburg, is now engaged in engineering work for the William A. Hardy & Son Co., 133 Water street, Fitchburg.

BLAW-KNOX EXHIBIT

The Blaw-Knox Company occupied Booth 716 in the National Exposition of Chemical Industries, September 12th to 17th, in the Eighth Regiment Armory, New York City.

The exhibit included samples of forge and hammer welded steel plate work, operating models of Blaw clam shell buckets, and sample Blaw-Knox Prudential Sectional Steel Building, also photographs of other products, including Blawforms, structural steel buildings, transmission towers, water cooled furnace appliances and miscellaneous steel plate work.

Construction Problems Handled by Experts

In connection with its plans for the reclamation of its semi-arid states the Brazilian Federal Government has retained Dwight P. Robinson & Co., Inc., engineers and constructors, of New York, to supervise a large amount of engineering and construction work. This work, which is located in the states of Ceara and Parahyba, will include the construction of five large dams—involving nearly a million cubic yards of concrete—to create storage reservoirs, some of which are to be larger than any artificial reservoirs existing elsewhere.

The work is to be conducted under the direction of the Brazilian government, and is under the direct control of the Inspectoria de Obras Contra as Seccas, which is a department of the Ministry of Viacao e Obras Publicas. The inspector-general in charge of the work is Dr. Miguel Arrojado Lisboa. Dr. Pires do Rio is the Minister of Viacoa e Obras Publicas.

Pasadena, Cal., will appoint a city planning commission.

Mayor Tryer, of Los Angeles, Cal., will appoint a harbor commissioner, the president at $4,000 a year and two other members receiving $10 each for attendance at each meeting.

PNEUMATIC CLEANING BRUSH

PNEUMATIC CLEANING BRUSH

For cleaning metal surfaces previous to painting and for other purposes there has been put on the market by the Ingersoll-Rand Company a brush five inches in diameter, made with wires of special heat treated steel that is intended to be used with standard No. 6 Little David Drill. It is very rugged and durable, operated at high speed, can be used in sharp corners and other cramped places, weighs only 11½ pounds and is adapted for many cleaning purposes.